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Boston University

BOSTON UNIVERSITY
SARGENT COLLEGE OF HEALTH AND REHABILITATION SCIENCES

Doctoral Project

**RESTORING EFFECTIVE SLEEP TACTICS (REST):
A SLEEP OPTIMIZATION PROGRAM FOR THE MILITARY
SPECIAL OPERATIONS COMMUNITY**

by

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requirements for the degree of
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ABSTRACT

Sleep disturbance is one of the most prevailing symptoms of decreased performance and compromised overall health of the general public. This is a national security threat because this problem is even more profound in the ranks of the United States military. Sleep disturbance after deployment is common among military personnel and during deployment, has many health and safety implications. There are many personal factors and environmental factors can affect quality and quantity of sleep in pre and post deployment settings.

Occupational therapy intervention for special warfare servicemembers that have problems with function as a result of sleep insufficiency is an emerging need. However, there are no current programs offered that have addressed this important occupation. There is a need to develop an evidenced-based occupational therapy interventions that addresses sleep hygiene, as well as behavioral and environmental practices designed to improve both quality and quantity of sleep of this special population. In response to this need, the author designed an effective nonpharmacological occupational therapy intervention program designed to improve quality and quantity of sleep

The project focused on 1) identifying evidence-based literature to support the benefit of non-pharmacological interventions for special warfare servicemembers, 2) designing a program that represented best practice while incorporating the holistic and occupation-based theoretical base of occupational therapy, 3) best practice for implementation the program, 4) conducting summative program evaluation, and 5) develop a dissemination plan and implementation budget.

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CHAPTER ONE – Introduction

Inadequate sleep secondary to insufficient sleep quality or quantity is a public health concern in which the military population is particularly vulnerable to (Williams, Collen, Wickwire, Lettieri, & Mysliwiec, 2014). Military personnel have been trained that they can adapt to insufficient sleep without consequence just as their body adapts to the rigorous physical training, although there is substantial scientific evidence that disputes this (Williams et al., 2014). The Diagnostic and Statistical Manual of Mental Disorders (DSM) defines insomnia disorders as subjective complaints of difficulty initiating or maintaining sleep or non-restorative sleep, occurring at least three times a week for at least one month (Vgontzas, A.; Fernandez-Mendoza, 2013). Insomnia and inadequate recovery are pervasive problems in society and has serious mental, physical, and spiritual implications if not resolved. There are a host of physiologic changes that occur as a result of even short-term sleep restrictions that contribute to declining overall health (Harris, Taylor, Drummond, Larson, & Potterat, 2015). All branches of the military have documented significant increases in sleep disorders in active duty and veteran populations over the past decade (Mysliwiec, Walter, Collen, & Wesensten, 2016). Continuous operations, substandard sleep environments, poor sleep hygiene habits, and lack of individual and organizational knowledge and prioritization of healthy sleep habits has been documented as the etiology of sleep disorders (Mysliwiec et al., 2016). Sleep is a neural and physiological restorative maintenance process that is vital to health and normal function, but also critical to military operational readiness (Mysliwiec et al., 2016).

Program Overview

The purpose of this project will be to provide special warfare operators with the knowledge, skills, and abilities necessary to optimize and improve sleep performance. In doing so, servicemembers in this population will need to fully and successfully participate in the intervention program that has been developed to meet this pressing need. For this project, weekly workshops were created to address and focus on issues identified in literature that contribute to sleep disfunction. These workshops will be executed in a small-group format with follow on individualized coaching to meet specific needs of the participants. This project will address these four components:

1. Sleep Science Education: Provide basic understanding of the sleep architecture such as what is sleep, the different stages of sleep, and sleep problems (difficulty going to sleep vs. difficulty staying asleep)
2. Self-awareness: Provide analysis of current sleep pattern and context to performance and overall health. At this point, baseline measurements are available to provide the context.
3. Intervention: Provide general behavioral and environmental recommendations to promote healthy sleep and gradual restructuring of behaviors or habits that negatively impact sleep performance
4. Individualized coaching: Provide specific cognitive or behavior recommendations to promote healthy sleep behaviors.

This project will serve to provide all participants with the tools necessary to improve sleep, which will improve performance resulting in improved overall health. Ultimately,

the result will be improved operational readiness of the special warfare community.

Scope of the Problem

It is the view of the author that appropriate management of sleep performance of special warfare personnel, offers commanders of these units' tactical advantage by maintaining unit personnel with a high state of alertness, decreased behavioral and health problems and increase readiness and resilience. Evidence suggests that erratic and long work schedules and deployments, are contributing factors to sleep problems which lead to numerous long-term health risks (Rice & Schroeder, 2019). Sleep is a restorative process and yet despite decades of research, it remains a mystery why the lack of sleep impairs brain function, but it does (Xie et al., 2013). Xie (2013) noted that sleep deprivation reduces learning, impairs performance in cognitive tests, prolongs reaction time, and is a common cause of seizures. A progressively worsening state of sleep deprivation leads to dementia and death (Xie et al., 2013). A National Institute of Health study postulates that proteins linked to neurodegenerative diseases, recirculates through the brain in cerebrospinal fluid (CSF); however, despite the high metabolic rate and fragility of neurons, there is no conventional lymphatic system to remove these toxic waste products (Xie et al., 2013). The restorative function of sleep utilizes a convective exchange of CSF and interstitial fluid (ISF) to remove the neurotoxic waste that accumulate from the awake central nervous system (Xie et al., 2013). Sleep deprivation is linked to a reduction in ISF which results in a suppression and increased resistance to the convective fluid exchange that removes neurotoxic waste (Xie et al., 2013). Researchers have also found a correlation to sleep deprivation and intelligence.

According to Seigal (2001), sleep deprivation causes low level brain damage resulting in impaired brain development and a reduction in learning ability. Occhionero et al. (2017) states that prolonged wakefulness of more than 16 hours produces a decline in attention, memory, cognitive speed, and vigilant attention and are significantly compromises time-based prospective memory tasks. Sleep deprivation compromises TBPM by affecting the mechanism that allows the integration of information related to time monitoring behavior with the prospective intention (Occhionero, Cicogna, & Esposito, 2017). Conversely, good sleep quality is associated with several positive outcomes to include better health, greater well-being and better psychological functioning (Harvey, Stinson, Whitaker, Moskovitz, & Virk, 2008). Sleep regularity has been observed to positively correlate with academic performance as noted from a study of specific college students (Phillips et al., 2017) Sleep serves an important function in thermoregulation of body temperature, energy balance and the ability to store and control the availability of energy (Engle-Friedman, 2015). A reduction in sleep quality accrued over several day, compromises essential physiological processes resulting in sleep debt (Robotham, 2011). The fact that sleep debt can be accumulated suggests that sleep serves important functions that require some portion of the what is missed to be made up (Siegel, 2005). This debt can only be repaid through sleeping, and without it can result in symptoms of poor concentration, irritability, depression, frustration, weakened immune system and psychological distress (Robotham, 2011). Motivated people can overcome short periods of sleepiness; however, they cannot perform at high levels for sustained periods (Siegel, 2005). Sleep deprivation has a bi-directional relationship with mental health (Robotham, 2011). To summarize,

sleep deprivation results in deficits in human performance across the spectrum and can be as dangerous as the impairments caused by alcohol consumption (Green & Brown, 2015). Current evidence provides data on how sleep is needed in order to carry out everyday tasks, facilitate learning and other cognitive processes (Green & Brown, 2015). The importance of sleep for overall health and performance have been solidified in sleep science research. The special warfare community executes high level military operations, which requires complex mental operations for the planning and execution of missions critical to national security. The ability to maintain alertness in situations with little mental or physical stimulation, such as providing security for your teammates or equipment maintenance, can be adversely impacted by poor sleep (Williams et al., 2014).

Occupational Therapy Domain

According to the American Occupational Therapy Association (AOTA), restful and adequate sleep provides the foundation for optimal occupational performance, participation, and engagement in daily life (Siebert & Schwartz, 2017). The AOTA reclassified rest and sleep in the Occupational Therapy Practice Framework (OTPF) as its own area of occupation removing it as a category in activities of daily living (Leland, Marcione, Niemiec, Kelkar, & Fogelberg, 2014). AOTA recognizes that individuals with poor sleep are restricted in their engagement in social activities, and there is a pervasive impact that poor sleep has on quality of life and occupational engagement (Leland et al., 2014). Until this point the occupational therapy profession has been willfully negligent in addressing sleep although it has been a standalone occupation in the OTPF since 2008. Coverage of the issue has increased as well as the advancement of sleep science to

understanding how sleep has such and overall impact on healthy function. Occupational therapy practitioners understand environment, routines, and occupation and now with increased scientific knowledge have to close the gap in these associations with sleep and health (Green & Brown, 2015). By addressing impairments with this essential occupation, the occupational therapy profession can better promote health and quality of life (Leland et al., 2014).

Management of sleep is within the portfolio of occupational therapy and is a necessary and logical step in the interest of restorative occupation (Green & Brown, 2015). Sleep has been a part of the occupational therapy framework for many years, however not fully understood until now.

Occupational therapy practitioners are an exceptional resource to assist and address the occupation of sleep. Sleep relates to occupational performance because sleep is a restorative process and is an occupation that is necessary for balance and health. Sleep and function have a reciprocal relationship. When sleep quality is compromised, daily function is also negatively affected. Sleep is how the body restores itself from wakefulness. Wakefulness of more than 16 hours creates a mental impairment that is equal to low-level brain damage (Green & Brown, 2015).

Impact of Project

The first study on sleep deprivation was published over 100 years ago; however, the meaning of sleep as well as the ramifications of sleep deprivation has since been extensively studied (Abrams, 2015). The simple truth is, sleep is a physiological need to maintain health and performance of daily activities (Harris et al., 2015) This doctoral

project has the potential to save and improve the lives of the special warfare community through a reduction in accidents, improved mental and physical health overall. It is critical to understand the role of sleep problems as well as the barriers to identifying, clinically managing and promoting healthy sleep habits. This project will also highlight the role of sleep on performance and health, review studies exploring the effect of sleep debt in the special warfare community, and provide the evidenced based blueprint to optimize sleep in order to maximize human performance. Occupational therapy practitioners have a vital role to play in this effort. This project also has the potential of being a comprehensive resource guide for preventing excessive sleep loss, determining the severity of sleep debt, and providing counter measures and intervention strategies for occupational therapy practitioners to address sleep insufficiency.

CHAPTER TWO – Project Theoretical and Evidence Base

This chapter is organized into two main sections with the first providing the overview of the problem and illustrating how the project is consistent with theory and evidence. The second section summarizes the evidence used to address this problem and guide the development of this project.

Understanding the Problem

The Occupational Therapy Practice Framework, which is the definitive guide and philosophical basis for occupational therapy practice, now regards sleep and rest as an occupation rather than an activity of daily living, which was the case in previous editions. Poor sleep has a pervasive impact on occupational engagement, restricts engagement in social activities, and overall degrades quality of life and therefore is an occupational domain (Leland, Marcione, Niemiec, Kelkar, & Fogelberg, 2014). Sleep as an occupational domain, plays a critical role in health and well-being and therefore should be consider a vital function by occupational therapy practitioners throughout the lifespan (Tester & Foss, 2018).

For a complete sleep, a person progresses through five sleep cycles and four stages. There are progressive physiological characteristics of each stage, with stages three and four providing the person with the greatest benefits while awake. The stages and benefits are depicted in Figure 1.

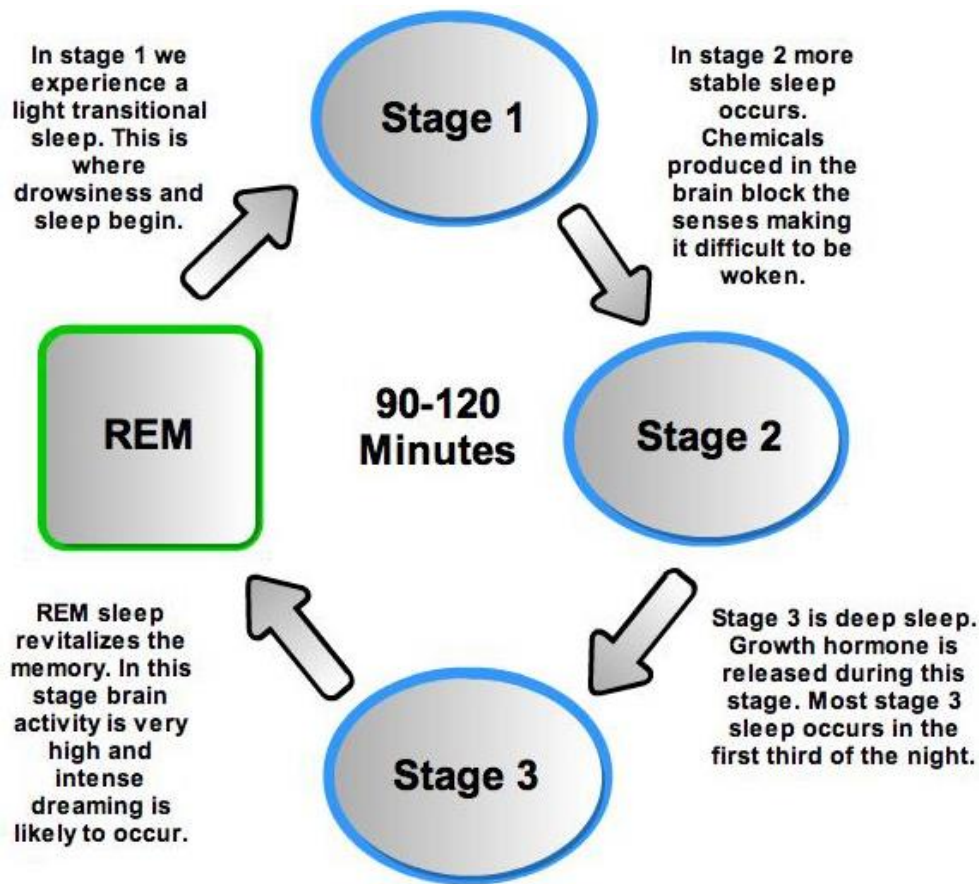


Figure 1. Stages of Sleep (adapted from American Sleep Association)

Poor sleep is the most frequent complaint of people with chronic illness, and the Centers for Disease Control and Prevention has recognized sleep insufficiency, as a public health epidemic (Tester & Foss, 2018). It is estimated that roughly 50–70 million Americans have a sleep or wakefulness disorder, which unfortunately is undiagnosed and untreated (Tester & Foss, 2018). Most health professionals consider poor sleep a secondary concern and therefore impairments from primary diagnoses are exacerbated when sleep impairment is ignored (Tester & Foss, 2018). Sleep is a state of altered consciousness that restores the body and influences mood, energy levels, behaviors (Tester & Foss, 2018). Sleep insufficiency impairs brain function, healing functions are

compromised, and deficits in attention and memory are noted (Tester & Foss, 2018).

Poor sleep quality is also one of the defining features of chronic insomnia and is a complex phenomenon widely associated with poor health outcomes and psychological functioning (Harvey et al., 2008).

The International Classification of Functioning, Disability and Health (ICF) provides a good framework for understanding the problem of sleep. The ICF was endorsed by World Health Assembly in 2001 as a common framework and language to describe the different aspects of human functioning and disability (Escorpizo & Homa, 2015). There is clear evidence that supports how the domains body function, activities of participation, and environmental factors contribute sleep disturbances. Figure 2 illustrates the ICF framework.

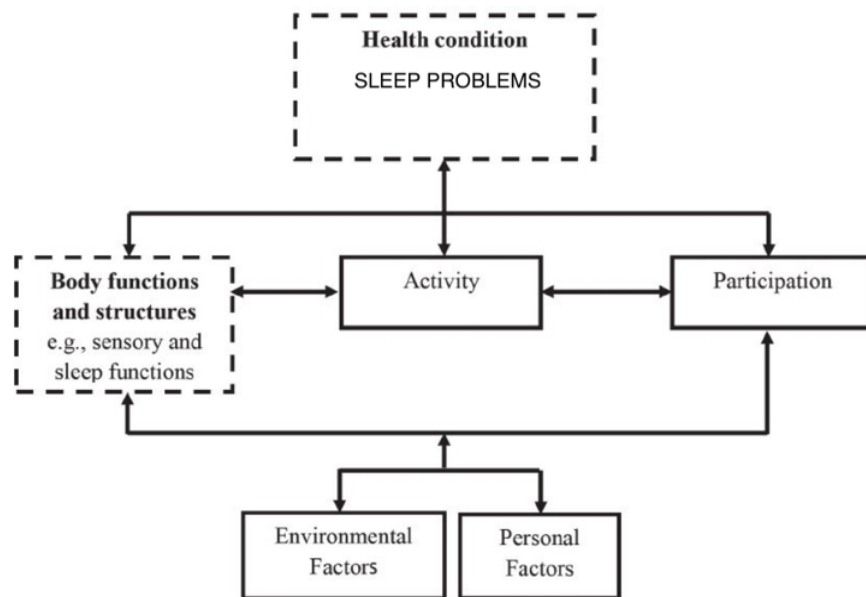


Figure 2. ICF Framework (This was adapted from ICF.org)

Body function includes sleep function and generally refers to various mental and cognitive functions and immediate physiological functions that can be impaired when

there is sleep is impacted. Activities of participation generally refers to the undertaking of multiple tasks for the purpose of daily living such as thinking, reading, problem solving and daily routines. Environmental factors include climate, technology, sound and light which are factors that can also impact sleep. Through these domains, the ICF illustrates the interrelationship and association between sleep disturbance and its impact on an individual's participation in life. The identified problem addressed by the author's project is sleep deprivation, and the goal is to demonstrate the effectiveness of non-pharmacological interventions provided by occupational therapy for improved sleep duration and sleep quality.

The adverse consequences of poor sleep quality can be assessed by measuring the loss of function represented by the domains of the ICF. Having a reduced quality of life because of disability or disease that is exacerbated by poor sleep can be an important determinant of social injustice in society. The interplay of poor health and activity participation that fulfill a person's life is the central theme in determining quality of life.

The Explanatory Model

In order to define the causes of sleep problems, an explanatory model was developed to show the relationships between the problem itself and the factors that influence the problem. This model, which is informed by the ICF, postulates that personal and environmental factors that contribute to adult's quality and quantity of sleep. The model (Figure 3) serves a logical method of understanding the author's description of the problem, approach to address the problem variables, the mechanisms of change and therapeutic goals.

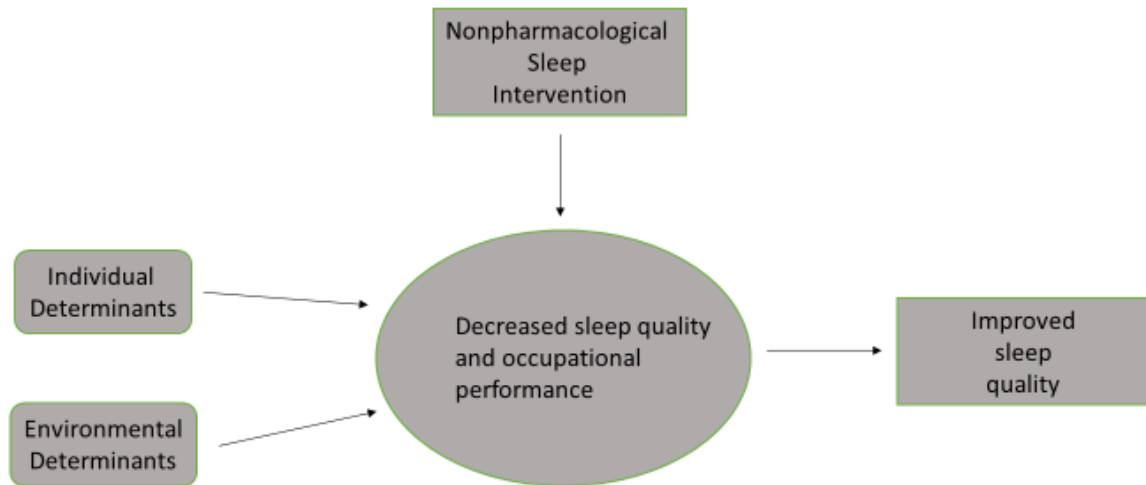


Figure 3. Explanatory Model

Evidence supporting the Explanatory Model

Several questions were developed to focus the literature search on the determinants of impaired sleep related to personal and environmental factors and evidence of effective non-pharmacological interventions to address sleep problems in general and the target population specifically. A search of the literature was conducted using PubMed, PsychINFO, CINAHL, MedLine, and AJOT. From the results, eight publications were chosen for review. The studies chosen were a mix of research studies and literature reviews. Two of the studies chosen focused on the use of cognitive behavioral therapy (CBT) as a nonpharmacological intervention for treating insomnia. Both studies conclude that CBT is an effective nonpharmacological treatment for insomnia symptoms. Koffel, Koffel & Gehrman (2015) conducted a systematic review of randomized control trial (RCT) comparing CBT to a control group of patients with insomnia and found 670 citations with eight meeting the criteria for analysis. The

outcomes variables for the included studies comprised of both qualitative and quantitative outcomes for sleep quality and sleep time as well as pain severity and depression with follow-ups ranging from 3-12 months post-treatment. This review found that there were significant improvements in overall sleep time, sleep efficiency, and wake after sleep onset; however, these findings were limited to treatment being performed in a group setting. Sivertsen et al. (2006) conducted a double-blinded RCT to examine the short and long-term clinical efficacy of CBT and pharmacological treatment of 46 adults with chronic insomnia. The study resulted in CBT improving sleep efficiency by 10% compared to pretreatment at a 6-month follow-up and a 1% decrease in sleep efficiency with the pharmacological group. The participants in the CBT group spent more time in sleep stages three and four with less time spent awake during the night. Time spent in sleep was supported with polysomnography data leading the authors to conclude that CBT interventions are effective in both short and long-term management of insomnia.

The relationship between the individual's behaviors, activities and physical health was examined to determine what impacts these variables have on sleep performance. Insomnia is a prevalent disorder that greatly impacts military personnel and exacerbates traumatic stress reactions such as post-traumatic stress disorder, depression, and suicide (Bramoweth & Germain, 2013). Comorbidity, medical and psychiatric disorders, chronic pain, anxiety and depression are contributing factors to the high prevalence of insomnia in military personnel (Bramoweth & Germain, 2013). Chen (2015) performed a cross-sectional study to investigate the prevalence of poor sleep quality in individuals with osteoarthritis and found that poor sleep quality was correlated pain, decreased physical

functioning, anxiety, depression and decreased health-related quality of life. The key predictors of poor sleep quality included role limitation secondary to poor physical conditioning, poor social functioning, higher anxiety and higher pain levels (Chen, McHugh, Campbell, & Luker, 2015). In a case control design study aimed at investigating sleep quality disturbances in patients, a comparison was performed on patients who underwent arthroscopic rotator cuff repair and no rotator cuff tear. The researchers concluded that patients with small tears in their rotator cuff have a poorer sleep quality and not only take longer to fall asleep but have more disturbed sleep compared to those with large and massive tears (Gumina et al., 2016).

There are also environmental determinants that impact sleep performance. Military researchers state that there is an increasing awareness of the importance of sleep and the military has now recognizes the need to better promote and educate members about sleep health (Mantua et al., 2019). A comprehensive review of literature identified four primary environmental factors that negatively impact sleep quality in traditional military settings which are light, noise, temperature, and air quality (Mantua et al., 2019). Light is an alerting stimulus and the presence of excess ambient light as small as 5 lux can disturb sleep (Mantua et al., 2019). Light is also a disrupter of the circadian rhythm which governs the sleep/wake cycle and alertness (Mantua et al., 2019). The lack of light exposure also throw off the circadian rhythm as well by making it become free-running making it difficult to fall asleep or wake up (Mantua et al., 2019). Noise is another notable factor that can disturb sleep. Ambient sounds that exceed the auditory awakening threshold of 35 decibels causes a disruption in sleep (Mantua et al., 2019). In a military

operational context, a military jet passing over can reach up to 135 decibels and may be as loud as 120–130 decibels at 200 feet away (Mantua et al., 2019). There is also a relationship between ambient temperature and core body temperature that can influence sleep performance (Mantua et al., 2019). Core body temperature decreases and skin temperature increases just before sleep onset, and continues for about six hours before there is a reverse of core body temperature and skin temperature (Mantua et al., 2019). Any disruption of this process leads to increased awakenings and less restorative sleep stages (Mantua et al., 2019). Although the human body can acclimate to extreme or harsh weather, it is not immediate and warfighters are often subjected to having to adjust (Mantua et al., 2019).

Theoretical Basis of the Intervention

After examining the evidence for the causation of sleep problems for special warfare military personnel, it appears that there is evidence to support person and environmental determinants that negatively impact sleep performance. The evidence reviewed for personal factors did not specifically target the military population but the general adult population; however, it is relevant to the problem being researched. The evidence reviewed for environmental factors did represent the target population for this project and therefore is also relevant. From the evidence, it appears that nonpharmacological interventions such as CBT and sleep hygiene education are effective approaches for addressing sleep performance problems. A program that encompasses both psychological and behavioral needs with follow-on coaching and assistance is the most effective means to addressing this problem.

The program will include training workshops for military servicemembers in the special warfare community to improve sleep quality and quantity. The Adult Learning Theory was used as a framework to guide the development of the training workshops. The targeted population consists mostly of active learners who thrive on direct exposure and enjoy being confronted with new challenges. This is direct knowledge from the career field and implied from the training they receive to adapt and overcome the most challenging situations. To address the unique learning needs of the adult population, the concept of andragogy (adult learner) holds a set of assumptions that adults learn in an atmosphere of mutual inquiry respect in a traditional environment. It approaches learning from a problem-based and collaborative perspective, emphasizing more equality between the learner and the teacher. Andragogy suggests that adult learners are self-directed, take initiative to diagnose learning needs and implement strategies to meet educational goals (Hagen & Park, 2016). As such, participants in this program will be encouraged to problem solve, set goals and continuously participate in the learning process. Participants will be encouraged to express themselves in a mutually respectful and safe environment.

CHAPTER THREE – Description of the Proposed Program

Current sleep medicine research has concluded that adequate sleep duration and quality are vital for optimal mental and physical health, cognitive functioning as well as physical and mental task performance (Troxel et al., 2015). Emotional and psychological well-being are correlated with longer sleep duration, increased rapid eye movement (REM) sleep which is associated with having better sleep quality (Howell, Digdon, & Buro, 2010). Since 2008, rest and sleep have been reclassified as its own area of occupation in the American Occupational Therapy Association's Occupational Therapy Practice Framework (OTPF) (Leland et al., 2014). Therefore, sleep is considered an essential occupation and occupational therapists can promote health and quality of life by addressing impairments in this occupation (Leland et al., 2014).

Sleep problems are prevalent in military populations, particularly among servicemembers who have deployed to combat operations (Troxel et al., 2015). Military life is characterized in large part by early start times, late working hours, and other non-traditional work schedules (Williams et al., 2014). Research further suggests that, combat exposure and the threat of injury to self or others inherent to working in combat theaters directly contribute to sustained increases in vigilance and arousal during wakefulness and sleep (Bramoweth & Germain, 2013). More than half of service members deployed in combat zones are sleep-deficient, and more than one-third of service members post deployment report having insomnia (Garner, Hopkinson, Ketz, Landis, & Trego, 2018). Literature suggests that sleep disturbances can persist for months or even years after deployments have ended and therefore it is critical to

understand the individual and system-level factors that contribute to the onset, persistence, and exacerbation of sleep problems (Bramoweth & Germain, 2013).

The focus of this doctoral project is addressing the lack of knowledge and integration of non-pharmacological sleep intervention in occupational therapy practice. This project is being authored by an occupational therapist working in the military community with servicemembers who would greatly benefit from improved quality of life as a result of enhanced sleep performance.

Goals and Objectives

This proposed program is designed to provide group-based, non-pharmacological occupational sleep intervention to special warfare servicemembers with sleep problems. Each week of the program will be broken down into several modules. The modules are designed to provide education to the participants on the various characteristics of sleep disruption, options to mitigate the negative consequences of prolonged sleep disruption and promote long-term sleep health specifically tailored to this elite population. After participating in the workshops, participants will:

- Demonstrate the ability to self-identify problems impacting sleep performance
- Demonstrate basic sleep science knowledge
- Discuss sleep hygiene strategies.

Target Population

The participants for the proposed program will be all active duty assigned to the Special Warfare Training Group (SWTG) who have had at least 1 deployment within 48 months. Special warfare is a group of elite military personnel that are trained to handle

an array of challenging operational situations and are expected to perform at a consistently optimal level. The specificity of this in the inclusion criteria is because sleep is reported to be extremely poor in deployed settings with 15% of military personnel averaging as little as 4.5 hours of sleep per night (Harris et al., 2015). These sleep problems have been noted to persist long after deployments have ended, partly because of conditioning, hyperarousal and behaviors that may be used to compensate for sleep problems in the short term but ultimately serve to perpetuate sleep problems in the long term (Troxel et al., 2015).

Objective

The proposed program is to address sleep disruption with the SWTG population using an evidence-based intervention toolkit focusing on sleep optimization. The program is designed to address the specific needs of special warfare operators with moderate to severe sleep disruption. The disruption in sleep results in problems with cognitive performance, anxiety, stress which is associated with an increase in accidents and injury risk.

Basis

Military operational readiness requires that sleep be regarded as a critical component, but it is commonly disregarded as part of operational planning (Mysliwiec et al., 2016). This program draws on the published literature that suggests that sleep problems are prevalent, and debilitating among servicemembers and is highly persistent among this same group during the post-deployment period. Specifically, servicemembers who have deployed are at high risk for insufficient sleep duration of an average of six

hours or less (Luxton et al., 2011). Daytime sleepiness and fatigue are consequences of insufficient sleep duration and poor sleep quality (Toblin et al., 2012). To address the overall research objective of this program, there were research questions derived to examine the problem. Literature reviews were conducted on the prevalence and consequences of sleep problems in the target population. The following research questions were developed for this project

- Is there evidence exists that supports the effectiveness of nonpharmacological treatment on sleep performance and quality?
- Is there evidence that exists to support individual determinant's impact on sleep quality?
- Is there evidence that exists to support environmental determinant's impact sleep quality?

To address these questions, the author used complementary methods of a literature review and a primary data collection on all sleep related surveys for the target population. The author has also performed a search for all military policies related to sleep and health for review.

Comprehensive literature searches for studies published between 2009 to present, was implemented using a broad range of search terms, such as sleep disorders, sleep hygiene, nonpharmacological, sleep disturbance, occupational therapy, sleep education , mental health, insomnia, sleep performance, actigraphy, PSQI, insomnia, circadian rhythm, fatigue, sleep loss, sleep interventions, melatonin, sleep monitoring, irregular sleep military, and veterans. Although the military ramped up deployments during the

years following the September 11th attack, high deployment rotations continued during the years included in the search range selected. Studies that identified risk factors, had strong correlation to consequences of sleep disturbances (Rice & Schroeder, 2019). However, greater focus and emphasis was placed on intervention findings. There is overwhelming evidence to support nonpharmacological interventions for sleep problems (Siebern & Manber, 2010) . Cognitive Behavioral Therapy (CBT) is seen as one of the most effective interventions for the most challenging behavioral changes with long-term benefits (van Straten et al., 2018). The literature also supports individual, environment and occupational determinants having an impact on sleep performance (Williams et al., 2014). Published studies on sleep problems amongst military personnel in the target population indicated combat exposure, separation from loved ones, irregular work schedules, high caffeine intake and other poor sleep hygiene habits such as alcohol consumption as perpetuating factors that contribute to sleep problems (citations). Whether it be a predisposing or precipitating factor causing sleep problems, the evidence clearly supports the author's use of nonpharmacological intervention.

Description of the Program

This sleep performance and optimization program is focused on integration of education and application of behavior modifications to improve sleep performance. The program will consist of a series of small group trainings once a week for four weeks. Groups will consist of 8-10 participants. Each week, a new topic will be covered. An overview of the program modules is illustrated in Table 3.1:

Table 3.1. Workshop Content

Week/Module	Topic	Content and Activities
Week One	Introduction	-Program overview -Basic Sleep Science -Why does sleep matter? -Activity: Self-Assessment (outcome measure) Wearable technology familiarization, self-monitoring, goal setting, competition setup
Week Two	Activate Plan	-Sleep Strategies -Activities: barrier identification/mitigation, group discussion, reviewing dashboard
Week Three	External Factors	-Sleep Hygiene Behaviors -Activities: Behavior feedback (physical activity, caffeine/alcohol intake, blue light exposure), light/noise/temperature strategies, sleep timing (time in bed, time to bed), group discussion

At the conclusion of the group sessions, the program will continue for an additional four weeks which will consist of 1:1 follow-up sessions in order to make personalized adjustments and address more specific needs of the individuals. The follow-up sessions will occur once per week and can be conducted in-person or via telephone. All group sessions and follow-up sessions performed in person will be conducted in the training center at the Special Warfare Training Squadron at Kirtland AFB and will be run by the author and architect of this program.

Potential Barriers and Challenges

There are several potential barriers and challenges for implementation of this program. Historically, military cultural attitudes tend to undermine the importance of sleep which is an ongoing challenge. A long-term goal of the program, will be to

eliminate the stigma attached to sleep, namely that sleep is for the lazy. The strategy for this would be through the use of education and bringing the focus not to sleep, but to the benefits of sleep which correlate to performance goals most in the population desire. Deployments may be the precipitating factor in the onset of sleep disturbances for this target group; therefore, it is important to consider the broader system-level factors that contribute to increased sleep problems during a deployment cycle. This involves identifying and reviewing policies and mitigating barriers to implementation of this program. The strategy to address this is to convene a panel of clinicians, leaders, researchers and members of the target population to develop sound recommendations for policy changes to address sleep problems. In the military operations, policy drives the budget and the budget drives the action. This is an important step to building collaboration and having a substantial impact on this population's ability to successfully reintegrate and rebuild their lives post-deployment.

Conclusion

The combination of increasing quality of life by addressing sleep performance of military servicemembers, is a much-needed practice. Thus far, the medical community as a whole has ignored sleep performance in servicemembers and are often ill-equipped to provide assistance which has created this crisis. The sleep health research community has created an opportunity to learn and reverse this problem, and this project has been created in this spirit. In the military community, getting the recommended amount of sleep is not only difficult, but considered a sign of weakness (Harris et al., 2015). Optimizing performance is highly sought after by the elite warfighters and is linked to sleep

performance (Harris et al., 2015). This project will utilize a small group education format to deliver the most effective nonpharmacological occupational therapy interventions for sleep disruption among operators in the special operations community. This population is unique in the military community because of higher level of fitness, high operations tempo which includes increased deployment cycles. As noted previously, sleep is extremely poor in deployed settings with personnel averaging 4.5 hours of sleep per night (Harris et al., 2015).

The concern is not based solely on the total number of hours slept, but also the quality and efficiency of sleep which includes latency, and the ability to stay asleep. Understanding these relationships and being able to improve the quality of life of our heroes and drive informed policy decisions has the potential to improve effectiveness, performance and even save lives.

CHAPTER FOUR – Evaluation Plan

Introduction

This chapter is intended to provide a thorough overview of this program's evaluation plan. The evaluation plan also serves a greater purpose by analyzing if the program is meeting the intent and highlighting components that could be enhanced to better meet the intended goals. The evaluation plan includes the overall vision, data collection, core purpose and goals. The program director will evaluate progression through the weekly phases of the cohort of participants through a process evaluation by examining weekly surveys. The examination will evaluate to what extent are expectations being met. During this examination, an evaluation of how well the participants gain sleep science competence and whether being made aware of this knowledge and metrics of their current performance encourage change. Indicators of program success, will be measured via the weekly benchmarks report. The program will evaluate processes by examining the program to ensure it was implemented with fidelity to the target population. It is expected that perceived sleep quality will increase as participants progress through the weekly modules gaining further insight in sleep science and the importance of sleep performance as well as knowledge of their performance on these measures. Sleep hygiene education coupled with behavioral modifications is a well-rounded approach to addressing sleep problems and this plan provides the blueprint for evaluation of the program designed to combat this problem.

Vision

Nonpharmacologic therapies to improve sleep are attractive because they avoid

the need for long-term medications and the potential side effects associated with them (King et al., 2015). Military leaders are becoming increasingly more cognizant of the importance of sleep for sustaining performance, safety, and health (Capaldi, Balkin, & Mysliwiec, 2019). The purpose of this project is to provide nonpharmacological sleep interventions for servicemembers in the special warfare community. Given the need to improve sleep quality among this population, the purpose for this evaluation is two-fold: 1) to examine the effectiveness of the sleep science education on behavior change of participants; 2) to measure the overall effectiveness of the program on overall objective and subjective sleep quality. Sleep is a restorative process that is required by the body for overall health and well-being and is within the scope of practice for OTs per the Occupational Therapy Practice Framework (OTPF). The purpose of this evaluation plan is to identify the strengths and weaknesses as well as actively assess goals and target areas of the program that need further development. To aid in this program evaluation, formative and summative assessments will be used. The formative assessment is a qualitative evaluation approach. Pre-and post-intervention surveys of the participants will be obtained as part of the formative program assessment. The information obtained from this source will provide validity from the participant on the program performance. The summative assessment will be used at the conclusion of the program to evaluate objective changes in sleep performance of participants.

Logic Model

The logic model for this program is shown in Figure 4. This model depicts the programs activities and intended impacts as well as detailing the relationships of

Program Title: Sleep optimization to enhance performance for special warfare servicemembers

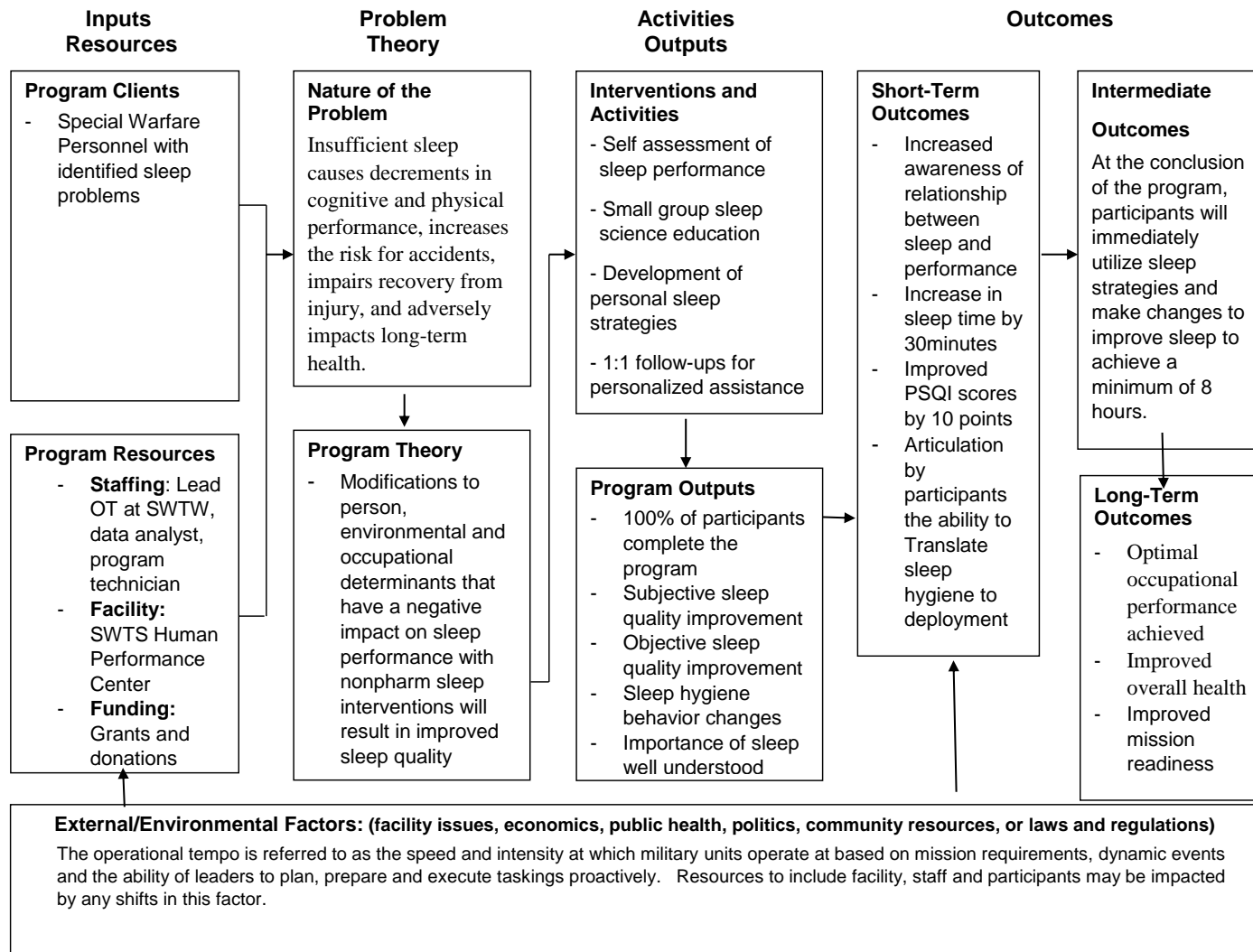


Figure 4. Logic Model

activities, outcomes and resources. The logic model provides the blueprint of the program and illustrates how the program will be evaluated.

The first aspect of the logic model defines the needs for the program and the target community. Based on those needs, short-term and long-term outcomes are established and program activities are designed to achieve those needs. The indicators of success being measured in the short-term goals and outlined in the logic model are improved sleep quality and performance. This measurement will be obtained from baseline to post-intervention through sleep quality measures such as the PSQI. The long-term expected outcomes for this project are improved health and overall occupational performance improvement. Occupational performance deficits were noted as negative outcomes of poor sleep performance, so inevitably this program has to focus on this long-term impact. As an intermediate goal of this program, participants are expected to continue to utilize strategies garnered during interventions to improve sleep after the program has concluded. This contributes to the long-term goal of sustainability and continued progress towards improved overall health and occupational performance.

Target population

The Special Warfare Training Wing (SWTW) houses the Human Performance Support Group, which is part of a special initiative that focuses not only on physically strengthening a special warfare Airman, but also rehabilitating them to ensure they are performing to their maximum potential for as long as possible. Military aircraft have dedicated maintenance crew chiefs and aircrews have flight medicine, and now special warfare Airmen have their own dedicated team working to ensure they are in peak

physical and mental condition to perform dangerous missions in the interests of saving lives on the battlefield. In this preserve the force effort, the human performance team embedded within the unit includes a physical therapist, occupational therapist, operational psychologist, strength and conditioning coach, athletic trainer, physician's assistant, and a flight doctor. Each of these specialists ensure Airmen are constantly challenged or correctly rehabilitated without having to leave the unit. The personnel targeted for this program are all a part of this unit. All special warfare Airmen are a part of the flight crew and are required to get flight physicals from the flight surgeon in order to stay on flight status. All personnel will be screened for sleep difficulty by the flight surgeon and referred for further screening to be a part of this program.

Recruitment

The 711th Human Performance Wing (711 HPW), headquartered at Wright-Patterson Air Force Base in Ohio, is the Air Force Research Laboratory's (AFRL) Institutional Review Board (IRB) which consolidates human performance research, education and consultation. The mission of the organization is to facilitate excellence in human-performance and technological research that advances warfighting capabilities in air, space, and cyberspace by efficiently processing and professionally evaluating proposals for scientific validity and uncompromising protection of the rights and welfare of volunteer subjects. The completion of this project will require approval from this organization. To get approval, submission templates will have to be completed along with a review of processes for submission of protocols. Also review applicable Regulations, including the most recent versions of Air Force Instruction (AFI) 40-102

Protection of Human Subjects and Adherence to Ethical Standards in Air Force Supported Research and AFRLI 40-102 Protection of Human Subjects in Research, both of which were substantially rewritten in the latter half of 2014. (Appendix X – AFRL Checklist). Lastly, all key personnel engaged in this project must have completed the AFRL-designated annual required training found for Government Civilians and Military Personnel and every three years complete the modules hosted by the Collaborative Institutional Training Initiative (CITI). The planned number of participants for this project is 10 based on a convenience sample.

Measurement and Data Gathering

Upon referral the participants will be evaluated for impact and extent of sleep difficulties using a pre and post-intervention questionnaire and standardized measures such as the Pittsburg Sleep Quality Index, Sleep Hygiene Index, Insomnia Severity Index. The PSQI is a self-administered questionnaire consisting of 19 individual items that measures different aspects of sleep with scores for subjective sleep quality, latency, sleep duration, sleep efficiency, disturbances, sleep medications, and daytime function. The Sleep Hygiene Index is also a self-administered questionnaire consisting of 13 items on a Likert scale requesting the individual to rate behaviors such as daytime napping, sleep/wakes times, sleep environment, and exposure to stimulating activity prior to bedtime. The Insomnia Severity Index is a 7-item self-administered questionnaire that assesses the participants perceived difficulties in sleep initiation, ability to stay asleep, satisfaction with sleep, daily functioning, and concerns of any sleep problems. During the 3-day pre-intervention (baseline period) and intervention period, participants will

wear the wrist actigraphy device for 24 hours a day to objectively record and measure all daily activity and sleep measures. The pre-intervention time will allow the device to learn the person and their normal biological patterns. Wearable devices have evolved and provide a low-profile method that will be a tremendous value to this project. The device that is being suggested for use throughout this project is the Whoop. Whoop measures the amount of time one spends in light sleep, slow-wave (or deep) sleep, and REM; it also tracks how many times an individual woke during the night and one's overall time in bed. The device functions as a pseudo-sleep coach, offering advice on how much one's body has recovered the previous day as well as how the participant should limit activities the following day (Breslow, 2016) Whoop has the ability to capture multiple streams of continuous physiologic data to include ambient temperature, sleep stages, sleep disturbances, sleep latency, daily physical strain, and heart rate variability. There will be a baseline period of three days, during which the device will learn the participant and capture all of aforementioned bio data prior to intervention. This method is favored in lieu of sleep diaries which will eliminate human error in determining number of hours of sleep. The web-based application associated with the wearable device will also capture subjective data from participants. Upon awakening daily, participants will open the application on their mobile device for daily feedback from the wearable and will be administered questionnaires about sleep performance, which is captured in the database for analysis. The device will capture and transmit all of this information via Bluetooth to the cloud server application. The control center will capture real-time information to be processed and analyzed by a proprietary algorithm that is configured based on the

biographical characteristics of the participant. This real-time access to data will demonstrate how education along with direct objective feedback to the patient can improve outcomes.

Data Collection

All data collected during this project will be electronic to include physiologic data from sleep performance and questionnaires. The primary advantage of this method is to improve validity and reliability. A Google Drive account will be setup to facilitate data collection for surveys and questionnaires to which all data analysis team members will have access. The online surveys using Google Survey, which will tie in directly to a system called SmartaBase, which will be used for all data analytics. The remaining data will be automatically collected using wearable devices.

Data Management and Analysis

Weekly module assessment surveys and a pre/post program survey will be used to evaluate program processes. Analysis of the sleep performance obtained from reports from the wearable device will involve comparison of baseline to end of program to determine whether there is an improvement in sleep quality as expected. Analysis of this data will involve examination of each individual according to their baseline performance and minimum sleep recommendations of eight hours. All outcome data collected via the surveys will be submitted will be imported into Smartabase and analyzed using pre-established analysis within the system which is based on sleep science recommendations and proprietary algorithms of Whoop. The program will utilize the services of a statistician to perform all data analysis.

CHAPTER FIVE – Funding Plan

The purpose of this chapter is to provide an overview of the costs of the project and potential funding sources to support the doctoral project. This overview will include embedded resources that are already available to be used for the project, as well as resources needed to be obtained, and potential funding sources. The project was conceived to address sleep performance needs of the special warfare community. The effects of sleep loss particularly with military operations has negative impacts cognitive abilities such as judgement, reaction-time, and problem solving which are militarily relevant (Capaldi et al., 2019). The implementation costs are associated with the costs of running the program within the special warfare training squadron. Dissemination costs are associated with presenting the program to the special warfare training wing for the initial implementation of the program, and also for the purpose of expanding the program to other geographically separated units (GSUs) within the organization. If the program is successful, the organization would be able to market the program to other units and request additional funding to support the program.

Embedded resources

There are key resources embedded within the organization that are available for the project. These include:

- **Human Performance Flight (HPF):** The staff of the HPF includes an occupational therapist, physical therapist, performance dietitian, physical medicine technician, and operational psychologist. The human performance team is charge with the responsibility of holistic health and maintaining an optimal level of performance

in physical, mental, and social practice of the special warfare community. Sleep performance serves as a holistic compass of sustainment of optimal well-being and performance of the warfighters within the organization and the community as a whole. This program is within the realm of responsibility of the core staff and the staff is capability of fulfilling the needs of the program without needing additional members that would increase costs.

- Technology hardware: The training room where all group session will be administered has projection equipment, computers, WiFi and big screen televisions that are compatible for instructional purposes. There are also data analytic computers in the research cell that have been cleared to help facilitate this project.
- Technology software: The unit has purchased the Smartabase Human Performance Platform for military which allows smart customizable autonomous real-time monitoring of any performance measures. Smartabase provides full data security and the ability to analyze data and configure reports that provide the information needed on demand. There are also purchases licenses for Survey Monkey and Google Docs which will be utilized throughout this project.
- Additional Personnel: The unit has a long-term contract with a technology company that is providing database administrators to deliver technical support for Smartabase. These technicians will provide full-time support with configuring Smartabase to provide whatever reporting data is needed. Currently there are over 400 performance measures being tracked including sleep.

- **Materials:** All print materials will be managed through the multimedia department on the base at no additional cost to the program. The unit has an account that is refreshed quarterly with sufficient funds to supply this program.

Needed resources

There is some equipment that would need to be purchased for the project. All members of the HPF already have computers with all the required applications installed. The sleep technology device used is a key element for this project. Several other devices are capable of measuring sleep related metrics but not all are accurate. Devices such as Oura, Fitbit, Fatigue Science band, and WHOOP were evaluated and have many pros and cons associated with them. Based on flexibility, cost and data analytics, the WHOOP was chosen as the best device for this project. Each participant will need a WHOOP wearable device for monitoring. The program is expected to start with ten participants at a cost of \$150.00 for each. The device requires a service subscription of \$30.00 a month with no contract. Follow-up are expected to be conducted for up to 1-year post the program so the service will continue for that time period. Potential discounts may be available for the military and will be incorporated to reduce costs. It is anticipated that in the first year, costs will be higher due to the purchase of technology equipment. If the program grows after the initial implementation, it is anticipated that equipment costs would continue to increase.

Program implementation costs

All of the costs for staff are already included in the agency's budget for salaries, so therefore there are no additional costs for staff. The members of the HPF are all

salaries and do not get paid for overtime hours. There are no overtime hours expected to be worked for the implementation of this project. A detailed budget for costs associated with implementation and dissemination of the program is included in the funding plan.

Table 5.1 details the only estimated expenses for the project.

Dissemination costs are also included, and they include the costs associated with presenting the project to other GSUs and expanding the program in the future to other units for a fee. The fee is the unit covering travel costs to have the team travel to consult on the implementation of the program at the remote location. This fee will vary based on the technology and support the unit has and the time to implement the program.

Table 5.1 Expenses

Item	Costs	Total
WHOOP Device (10)	\$150 each	\$1500.00
Monthly Service (10 x 12 months)	\$30 month	\$3600.00
Total		\$5,100.00

Potential funding sources

Much of the project as it is proposed are already covered in the agency's budget for equipment and resources already available and performing many concurrent services. Technology hardware is readily available as well as the complete complement of staff as part of the HPF.

There are potential funding sources for the wearable technology that would need to be purchased before the project can begin. These potential funding sources for the

implementation of the program are outlined in Table 5.2.

Table 5.2: Funding Opportunities for Program Implementation

Funding Type	Funding source and description
Federal grant	The National Institute of Health has grants provided for the purpose of discrete, specified, circumscribed research projects.
Community Health Sleep Award	The American Academy of Sleep Medicine Community Health Sleep Award provides support to a wide range of projects spearheaded by community leaders and or interprofessional individuals who are dedicated to addressing sleep health needs and sustaining sleep well-being.
Department of Defense – Congressional Directed Medical Research Programs	Department of Defense has funding opportunities for research projects that impact psychological health.
Strategic Research Award	The American Academy of Sleep Medicine has a research award program aimed at fostering patient-oriented research in sleep medicine that improves outcomes and demonstrate value.

Dissemination Costs

Many of the dissemination activities can be completed without additional costs. For example, costs for the program’s evaluation results, executive summary presentation to key stakeholders, and all print and presentation materials will be covered in the organization’s operational budget. To assist with providing stakeholders accounting of personnel used for the purpose of this project, all personnel will have an accounting code given to use in project tracking to specify time dedicated to this project. The projected budget of time is outlined in table 5.3.

Table 5.3 Projected Staff Utilization

Staff	Pre-Program	Week 1	Week 2	Week 3	Post-Program
Occupational Therapist	20	40	40	40	40
Smartabase Technician	40	20	20	20	40
PM Technician	4	4	4	4	0
Dietitian	4	8	4	4	0
Operational Psychologist	4	8	4	4	0
Physical Therapist	4	4	4	4	0
Total	76	84	76	76	80

Conclusion

This funding plan details the costs, potential funding opportunities and projected staffing hours to execute this sleep intervention program. A typical program of this nature would require additional resources to implement a program of this scope and nature. This program leverages resources already embedded within the organization that will cover the majority of the costs associated with implementation. It is anticipated that this plan will not only lead to successful implementation of the program, but contribute to the growth of sleep hygiene education across the Air Force Medical Service.

CHAPTER SIX – Dissemination Plan

Sleep insufficiency has been linked to numerous negative outcomes including impaired cognition, cardiovascular disease, and poor overall health (Luxton et al., 2011). Short sleep duration is commonly reported among recently deployed service members (Luxton et al., 2011). There has been a high operational tempo since the start of Global War on Terror in 2001, which has resulted in many service members experiencing multiple deployments to active theaters (Luxton et al., 2011). Therefore, the objective of this doctoral project is to optimize sleep performance of a specific group of active duty service members that have learned poor sleep practices, circadian misalignment, and subtle cognitive and motor impairments that contribute to physical and occupational impairment. This doctoral project utilized evidence from the research literature to create a program designed to educate and guide the service members participating in this study with the skills necessary to develop habits and routines as well as provide individualized assistance to improve sleep performance. This program incorporates principles of the adult learning theory to provide group training workshops with follow-up coaching assistance. Goals for participants include: (1) understanding of basic sleep science; (2) self-identification of poor sleep practices; (3) self-efficacy for adopting changes to improve sleep performance. This chapter describes the dissemination plan, provides an overview of the short and long-term dissemination goals, and other diffusion activities.

Dissemination Goals

Long-term goal: Increased awareness of the importance of quality sleep will result in better self-assessment and recognition of sleep problems, and lead to stronger

community support for programs that combat the problem.

Long-term goal: Provide education to key stakeholders about evidence based nonpharmacological interventions to optimize sleep performance before and after deployment.

Short-term goal: Provide awareness of the value of proactive interventions focused on increasing quality and quantity of sleep in a high operational tempo unit.

Short-term goal: Increase self-efficacy of program participants about how making modifications in personal and environmental factors can enhance sleep and improve overall health.

Target Audiences

Primary Audience: The primary audience for the dissemination of information about this program and its evaluation is the Special Warfare Training Wing leadership. The leadership that have been identified as the key stakeholders include the Wing commander, Support Group commander, Training Group commander, Human Performance Squadron commander, Operational Medicine Squadron commander, and Group Medical administrator. This leadership team has the greatest influence on greater promotion of the program from the highest level. Their involvement also offers the potential of expansion and the ability to add resources. The results of the program evaluation will be discussed with the Group Medical administrator medical administrator who may use this information to help advocate for changes in policy and practices within medical operations. The administrator can also use the program evaluation results to assess the benefits and cost-effectiveness of expanding the program to other

geographically separated units within the Special Warfare Training Wing.

After successful implementation of this program, secondary primary audiences for dissemination include the Military Veterans Advocacy and the United States Senate Committee on Armed Services. One of the primary objectives of the Military Veterans Advocacy is to pursue through the legislative process, actions to protect and expand the rights and benefits of current and former members of the armed forces. This non-profit organization establishes relationships with members of Congress, Senators and their staff as well as staff of the House, Senate and Armed Services and Veterans Committee. The Committee on Armed Services have been given the authority by the Senate to study and review, on a comprehensive basis, matters relating to the common defense policy of the United States, and report thereon from time to time. The purpose of dissemination to the Committee on Armed Services is to advocate for more funding towards sleep programs such as this in the military. The secondary audiences for the dissemination of this program and its evaluation results include all human performance and operation medicine practitioners in the Special Warfare Training Wing.

Human Performance Staff: The Human Performance Staff (HPS) consists of physical therapy, occupational therapy, performance dietetics, operational psychology, and strength and conditioning specialists. All members of the team would benefit from knowledge of the findings of this program. Members of HPS are responsible for constantly assessing performance special warfare unit members. The members of HPS would benefit from the knowledge of the principles of this program to improve sleep performance. By increasing awareness of resources that are available to improve sleep as

well as overall health and well-being of unit members, the members of HPS can better meet the health and wellness needs of the service members.

Operational Medicine Practitioners: The Operational Medicine Squadron (OMS) consists of flight surgeons (physician), physician assistants, paramedics, independent medical technicians, and athletic trainers. These providers also are responsible for maintaining and improving the health of unit members and may benefit from knowledge of role of sleep on performance. The goal is to expand the knowledge of other practitioners of occupational therapy's role in addressing sleep as an occupation.

Key Messages

Military Leadership

The results of the program evaluation suggest that non-pharmacological interventions improve quality and quantity of sleep in special warfare operators. Acute and chronic sleep disruption for the target population, has been noted with deficits in health, psychological well-being, hindered decision-making, and alertness management in an operational environment (Capaldi et al., 2019). Special warfare personnel are a group of elite military personnel that are trained to handle an array of challenging operational situations, and are expected to perform at a consistently optimal level (Harris et al., 2015). The author's evidenced-based approach to address the negative factors impacting sleep performance will result in optimal performance and overall well-being.

Occupational Therapy Practitioners

Over 70 million Americans are affected by sleep disorders which significantly diminish health, alertness, and safety (Liu et al., 2013). Long-term use of sleep

medication has negative side-effects such as dependency, fatigue, drowsiness, nausea, and cognitive issues (Gutman et al., 2017). Because of these negative outcomes, non-pharmacological intervention programs are in great demand and the American Occupational Therapy Association has called for occupational therapists to become involved in addressing sleep hygiene (Gutman et al., 2017). Sleep intervention is within the domain of occupational therapy and there is evidence to support occupational therapy practitioners providing this level of care (Gutman et al., 2017).

Special Warfare Community

There are a host of physiologic changes that occur as a result of sleep disruption which can also contribute to declining health (Harris et al., 2015). The education that provided to the special warfare operator during this program, will not only have a positive impact physical, mental, and spiritual well-being, but is also critical for improving the readiness of these elite military personnel.

Communication of Message

Military Leadership:

A presentation will be prepared for military leadership of the special warfare training wing which will include an executive summary of the program and the results of the program evaluation. The wing commander would be more likely to consider funding the program on a larger scale if the information presented in the program is well thought out and provides evidence of its effectiveness. Information about the program will be disseminated throughout the organization at all monthly commander's calls, quarterly resiliency training events, and electronic communications such as the monthly situation

reports by the commander that has visibility by the entire organization.

Occupational Therapy Practitioners

There is only one other occupational therapist assigned to the Special Warfare Training wing at one of the other geographically separated units. Information about the program, implementation, and results will be shared for the purpose of replication of the program. There is a SharePoint server that is shared between the separated units to allow for data sharing which will facilitate easy access to documentation. There are also audio-visual capabilities that will facilitate the training requirements as well as remote coaching.

Other Dissemination Activities

Written Information: The author will prepare and submit a written article describing the program, purpose, implications, participants, research methods, discussion, results, and implications for occupational therapy practice and submit for publishing in American Journal of Occupational Therapy. This dissemination activity will provide useful information to occupational therapy practitioners on the use of non-pharmacological interventions being used successfully in clinical practice to optimize and improve sleep quality.

Presentations: A PowerPoint presentation will be created and utilized to outline the program and be delivered at “Kirtland Talks”. Kirtland Talks is a platform that Kirtland Air Force Base uses to allow a member of the community to give a short, inspirational talk on various topics related to resiliency patterned after the popular "TED Talks". This is birthed out of the “Wingman Concept” that is very popular in Air Force culture. The

“Wingman Concept” means helping each other anytime, anyplace. In aviation, the lead pilot’s wingman, would stay behind while in flight a short distance to look out and provide support if needed. This concept of looking after and supporting each other has been adapted throughout the Air Force whether on the ground, downrange, or at home.

Electronic Media: Throughout the organization, there are monitors setup that deliver information important to members. A slide will be created with information about the program and benefits on constant rotation that can reach every person in the organization several times a day.

Person to Person Contact: Before receiving treatment in the walk-in acute care clinic, each member must sign-in and answer as short questionnaire. A sleep questionnaire will be added to the existing questionnaire and based on the responses be followed up by program staff.

Budget

The dissemination activities outlined in this program, mostly require time commitments and minimal additional financial support for implementation. However, there are some proposed travel expenses associated with the advocacy activities to travel to Washington, DC to meet with representatives of the Military Veterans Advocacy and possibly the Committee for Armed Services. There may be travel expenses include travel costs, lodging, meals, and handout printing costs which have been estimated in Table 6.1.

Table 6.1. Dissemination Expenses

Expense	Cost	Total
Airfare	550.00	550.00
Lodging (4 nights)	150.00	600.00
Meals (5 days)	75.00	375.00
Transportation	75.00	375.00
		\$1900.00

Evaluation**Written Information**

Having the journal article accepted and published for review will be considered a successful dissemination activity. Additionally, feedback received from reviewers can and will be utilized to evaluate the success of this activity. The requests for further information about the program will also be an indication of success of this dissemination activity.

Person to Person Contact/Electronic Media

For all contacts in the walk-in acute care clinic with noted sleep problems, each would be asked about whether they reviewed the information monitors and found the information on sleep to be useful and made them think more about their sleep. This information will be tracked in Smartabase to evaluate the electronic media reach and record comments to determine the success of this dissemination effort.

Conclusion

This chapter detailed the dissemination goals, target audiences, key messages and

dissemination activities pertaining to an occupational therapy focused sleep optimization project for a target military population. Additional advocacy activities were discussed to gain further reach of this project, as sleep is not just a need for the target population, but also the entire military and general population. The budgetary considerations were also addressed for the advocacy activities and the potential significance of this cannot be underestimated. It is believed that the combination of all these activities will result a successful program and has the potential to be a legacy program that changes lives for the better.

CHAPTER SEVEN - Conclusion

The Restoring Effective Sleep Tactics program is focused on using current evidence to develop occupational therapy based non-pharmacological sleep interventions for a specific at-risk military population for sleep problems. The project was created by an occupational therapist working in the military setting with members of this group who would benefit from the use of program. A review of the research evidence highlights the need for such a program in the special warfare community to improve sleep performance which leads to better performance and overall better health. This chapter will review the theoretical framework used to create the project, the research evidence that guided the project and implications for occupational therapists working in any setting addressing the needs of sleep.

The program is designed to provide non-pharmacological interventions to improve sleep performance for a special military population. By providing specific and evidence-based interventions, members of this elite group of servicemembers will have access to care that will improve their overall health and well-being as well as performance. The discussion presented going forward will be the project's innovative approach of integrating theory and evidence into the design of a program that uses both behavioral therapy and technology. Finally, the implications for occupational therapy practice are discussed for this project.

Integration of Theory

The creation of this doctoral project is based on the four principles of Andragogy, or adult learning theory. The relationship between the individual's behaviors, activities and physical health was examined to determine what impacts these variables have on sleep performance (Bramoweth & Germain, 2013). The four principles of adult learning theory have demonstrated, that in order to have an impact on learning when applied to adult instructional practices, it is key to understand the environment, response, and premise that adults learn (Hagen & Park, 2016). According to Hagen & Park (2016), adults as self-directed learners, the role of prior experience, an adult's readiness to learn and orientation to learning are the key principles. These four principles have been incorporated in this project by providing choice in workshop participation, upfront goals and objectives of each workshop, follow up individualized coaching, and allowing for individual choice in the experience. Using these principles as a guide in the workshops and follow up training will provide the most effective environmental experiences for participants with varying sleep related problem needs.

Integration of Evidence

Research literature in sleep problems using nonpharmacological interventions reveals that cognitive behavioral therapy approaches significantly improves sleep performance (Blake, Sheeber, Youssef, Raniti, & Allen, 2017; Nishinoue et al., 2012). Additional review of the evidence shows that combining education with behavioral changes improve sleep performance (Farrehi, Clore, Scott, Vanini, & Clauw, 2016; Kaku et al., 2011). The principles of adult learning theory implemented as outlined above,

along with an effective education and behavioral change program for this special population will be established. The program will address the needs of servicemembers in a special career field that require rapid and frequent deployments and address the helplessness feeling perceived because of the job requirements.

Implications for Occupational Therapy

Sleep problems are prevalent among adults and are associated with negative health outcomes (Leland et al., 2014). Occupational therapists work in a variety of settings and are primed to address sleep problems as it is identified as a scope of practice in the Occupational Therapy Practice Framework as a standalone occupation (Leland et al., 2014). The American Occupational Therapy Association has called on Occupational Therapy practitioners to become more involved in addressing sleep problems knowing that both physical and mental disabilities are commonly treated by the profession (Gutman et al., 2017). Over the last decade, occupational therapy literature has increasingly addressed utilizing non-pharmacological sleep intervention approaches to improve sleep performance and enhance occupational performance (Gutman et al., 2017). The influence of sleep on health in general necessitates occupational therapy practitioners taking a variety of steps to enhance awareness, develop standardized sleep assessments and interventions specific to improving sleep in our practice settings (Tester & Foss, 2018). As we move forward in our practical understanding of how sleep impacts our client populations, it will be important to continue to prioritize improving our research efforts in targeting sleep assessments to meet our clinical needs to establish and to standardized the evidence base for treatment interventions for sleep optimization

(Tester & Foss, 2018). This project was created in that spirit and has the potential to expand occupational therapy services to a special population.

In conclusion, the doctoral project *Restoring Effective Sleep Tactics (REST): A Sleep Optimization Program for the Special Warfare Community* is an innovative solution to a problem for a special population. This doctoral project has been established to address the well documented problem utilizing an evidence-based approach. The program incorporates strategies improve a problem set for a special population structured from the adult learning theory. Executing this program will enable members of the special warfare community to improve their performance, reduce risks on the battlefield and enjoy the benefits of improved overall health. The innovation integrated in this program has the potential to become a model for professional development in the occupational therapy in any practice setting for addressing sleep optimization.

APPENDIX A: EXECUTIVE SUMMARY

Background

Sleep is a complex and vital function that is critical not only to maintaining health, it is essential to the immune system, emotion and mood modulation, neuroplasticity, cognition, learning, basic human function, and occupational performance (Fung, Wiseman-Hakes, Stergiou-Kita, Nguyen, & Colantonio, 2013). Occupational therapists are concerned with sleep as a cornerstone of health and wellbeing (Eakman et al., 2017). Adolf Meyer, a pioneer and founding father of occupational therapy, was the first to recognize the vital role of sleep in health and well-being (Green & Brown, 2015). Because of Adolf Meyer's advocacy, the American Occupational Therapy Association (AOTA) classified sleep as an activity of daily living (Tester & Foss, 2018). Research has highlighted the significant role of sleep, prompting AOTA to reclassify sleep as a separate domain in the Occupational Therapy Practice Framework in 2008 (Tester & Foss, 2018).

Sleep is a separate domain of function because it is critical to health and is an essential aspect of daily life. Consequences of poor sleep are multifaceted and can include fatigue, impaired memory, errored judgement, and decreased physical performance (Eakman et al., 2017) Currently, the first-line treatment by several healthcare providers for sleep problems are pharmacological interventions despite the increasing evidence of negative side-effects to medications include dependency, decreased daytime function, neurological impairment (Gutman et al., 2017). In 2014, the Occupational Therapy Association called for occupational therapists to be more involved

in addressing sleep hygiene and how it impacts daily function (Gutman et al., 2017).

Although recent literature supports the use of nonpharmacological intervention by occupational therapists to enhance and optimize sleep performance (Gutman et al., 2017), there is a gap in clinical practice by occupational therapists in the area of sleep.

This doctoral project focuses on addressing the lack of integration and use of nonpharmacological sleep interventions in occupational therapy practice within a specific vulnerable population, namely active duty service members. The project was created by an occupational therapist working in the military setting with active duty servicemembers who have varying sleep difficulties that interfere with performance of their duties and overall health and well-being. Service members can benefit from nonpharmacological approaches to address sleep difficulties including the use of sleep science education, individualized coaching, and other lifestyle and cognitive interventions to improve sleep performance and overall health, well-being and occupational performance. The doctoral project was created to address the identified problem incorporating an evidence-based nonpharmacological approach.

Project Overview

Current literature indicates that sleep problems have a direct correlation to personal, environmental and occupational determinants (Eakman et al., 2017).

Specifically, for active duty service members, these determinants include, operational stress, poor sleep hygiene, and high operational tempo with prolonged vigilance.

Members of the special warfare community are at greater risk because of the frequent deployment schedule. The study of sleep problems suggest that they are omnipresent in

the military and is associated with negative cognitive, physiological, operational functioning deficits which also negatively impacts mission success (Mantua et al., 2019). Sleep optimization workshops have been created for this doctoral project to provide members of the special warfare community to solve this problem because of their high vulnerability for sleep performance problems due to the nature of their training and work characteristics.

The workshops provide participants with the opportunity to learn how to use and integrate the knowledge of the importance of sleep with nonpharmacological interventions to improve sleep performance. The program also utilizes wearable technology that reinforces education, influences positive behavior change, and provides live objective feedback to allow the participants to make on the spot changes that will improve sleep performance. The specific nonpharmacological interventions have been chosen based on the success, low-cost of implementation, and ease execution and replication. The cost to fund the program for two years is noted in Table 1.

Table 1. Expenses

Item	Costs	Total
WHOOP Device (10)	\$150 each	\$1,500.00
Monthly Service (10 x 12 months)	\$30/month	\$7,200.00
Total		\$8,700.00

Key Factors

The program design was informed by a review of current literature which

identified the most successful approaches in nonpharmacological sleep intervention. Integration of the principles of the adult learning theory was a key focus of the program format to address the unique learning needs of this highly resilient adult population who have learned through military training to adapt and overcome the most challenging situations. The small group format with the use of social and emotional connections through facilitated discussions are in-line with the theory. Adults are highly motivated to learn in areas that help to improve and or advance social roles, as they are physiologically designed to support these important relationships (Hagen & Park, 2016). Training creates physiological changes in the brain, which has been widely studied in educational settings and is elemental to the notion of neural plasticity (Hagen & Park, 2016). Utilizing a learner centered approach but also incorporating practical application of hands-on activities, collaboration among participants, results in increased participation, comfort, and effort. Moreover, participants will be able to implement and receive immediate feedback from the use of the wearable technology. The workshops will be conducted over three weeks and are outlined in Table 2. Through participation in the workshops the participants will develop the skills necessary to improve not only their sleep performance, but their overall health.

The goals of the program workshops are for participants to:

- Demonstrate the ability to self-identify problems impacting sleep performance
- Demonstrate basic sleep science knowledge
- Actively discuss sleep hygiene, troubleshoot and develop sleep improvement strategies.

Table 2 Workshop Schedule

Week/Module	Topic	Content and Activities
Week One	Introduction	-Program overview -Basic Sleep Science -Why does sleep matter? -Activity: Self-Assessment (outcome measure) Wearable technology familiarization, self-monitoring, goal setting, competition setup
Week Two	Activate Plan	-Sleep Strategies -Activities: barrier identification/mitigation, group discussion, reviewing dashboard
Week Three	External Factors	-Sleep Hygiene Behaviors -Activities: Behavior feedback (physical activity, caffeine/alcohol intake, blue light exposure), light/noise/temperature strategies, sleep timing (time in bed, time to bed), group discussion

Workshops consist of small group instruction (eight to ten participants) where each participant will have the opportunity to use the wearable technology and receive objective feedback of their sleep performance and coaching on how to make effective use of the data to improve their performance. Additionally, the workshops will focus on a specific learning objectives and application of strategies intended to address the sleep optimization needs of this specific participant population. At the conclusion of the workshops, participants will have one-on-one follow-up coaching sessions for up to a year. The individualized one-on-one coaching sessions are designed to hone in on any specific problems and with implementing personal sleep performance strategies.

Evaluation

The goal of evaluation is to show the residual impact of using different sleep intervention approaches that translate easily to daily routines. Baseline and post intervention surveys will be used to determine the effectiveness of the interventions,

delivery of the program and long-term impact. Multiple surveys are expected to show that using a hands-on approach to training alongside collaboration between participants will result in both an increased comfort level in the implementation of skills such as mindfulness and an increase in the integration into daily routines (Brown, Wielandt, Wilson, Jones, & Crick, 2014).

Funding

This project was conceived to address sleep performance needs of the special warfare community of the United States Air Force. The implementation costs of running the program within the special warfare unit are for the initial implementation of the program, and expanding the program to other geographically separated units (GSUs) within the organization. There are a number of key embedded resources that are available to the program without any additional funding required. One key resource is the staff of the human performance flight which includes an occupational therapist, physical therapist, performance dietitian, physical medicine technician, and operational psychologist. Additional key resources include but are not limited to, technology software and hardware of Smartabase, projection equipment, computers, and online survey tools platforms.

Conclusion

This program was created to address the needs of a highly underserved and vital population. There is clear evidence that identifies sleep performance as a problem in the special warfare community, as well as nonpharmacological interventions as the most effective long-term solution to address the harmful and sometimes catastrophic effects

from sleep problems among the special warfare community. Implementing this program as it has been outlined, special warfare operators will have the tools necessary to improve not only combat operations, but their overall quality of life. In addition, this program has the potential to improve healthcare costs in the Air Force Medical Service, as well as provide an evidence-based professional development platform for other occupational therapists in any setting.

APPENDIX B: FACT SHEET

**Restoring Effective Sleep Tactics (REST): A Sleep Optimization Program for the Military Special Operations Community**

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Candidate

Introduction to REST:

The premise of Restoring Effective Sleep Tactics (REST) is that with formal and structured training on self-identification of the signs and symptoms of sleep problems, coupled with providing specific strategies to address those problems, the highly vulnerable special operations community will successfully demonstrate objective and subjective improvement in sleep performance.



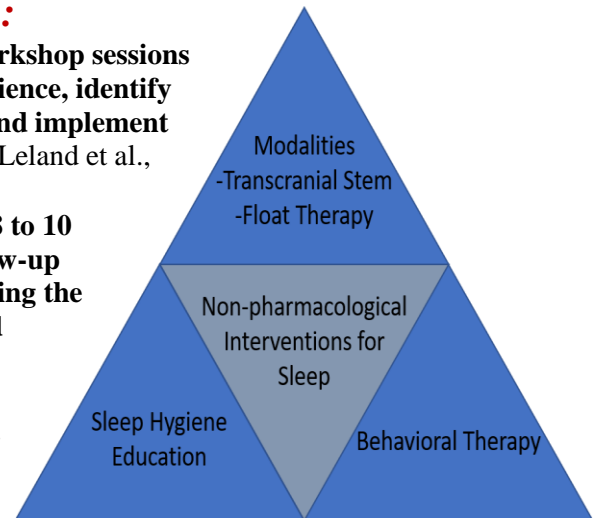
Introduction to the problem

- Sleep disturbances are a common reaction to stress and are reliably and prospectively linked with a host of adverse mental and physical health outcomes, including increased risk of depression, suicide, posttraumatic stress disorder (PTSD), accidents and injuries, cardiometabolic disorders, and mortality (Troxel et al., 2015).
- Within the armed services, obtaining the recommended amount of sleep is difficult and an ethos exists that sleeping is a sign of weakness (Harris et al., 2015).
- Physicians commonly treat sleep problems with pharmacological interventions although evidence has demonstrated many negative side-effects including dependency, day-time drowsiness, nausea, fatigue, confusion, and memory problems (Gutman et al., 2017).
- Research suggests that for many service members, sleep problems persist long after deployments have ended and can have a substantial impact on their ability to successfully reintegrate and rebuild their lives post-deployment (Troxel et al., 2015).



Solution to the problem:

- Participants will complete 24 hours of workshop sessions designed to help them learn basic sleep science, identify behaviors impacting sleep performance and implement strategies to improve sleep performance (Leland et al., 2014).
- The workshops will be in a small group (8 to 10 participants) format, with unlimited follow-up individual coaching and/or training. During the first workshop, participants will be issued wearable technology for objective sleep feedback.
- This program is focused on integration of education and application of behavior modifications to improve sleep performance.



Role of Occupational Therapy in Sleep:

- In 2008, the American Occupational Therapy Association's (AOTA) Occupational Therapy Practice Framework (OTPF) reclassified rest and sleep as its own area of occupation, no longer categorizing it as an activity of daily living
- Qualitative studies by Green (2008) and O'Donoghue and McKay (2012) have illustrated the pervasive impact poor sleep has on quality of life and occupational engagement (Leland et al., 2014)
- Rest and sleep are clearly identified as critical occupations in the OTPF
- Occupational therapy is primed to address sleep problems by targeting the context and environment, performance patterns, and limited engagement in evening activities that may contribute to poor sleep

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